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Character Association and Path Analysis for Agronomic Traits in Diverse Okra (*Abelmoschus esculentus* (L.) Moench) Genotypes

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation aimed to determine the intercharacter relationships among morphological characters in a diverse collection of 48 okra genotypes, including landraces, exotic, and indigenous accessions grown at an agriculture farm, near Sivapuri village, Tamil Nadu during January – May 2022 with the objective of enhancing the yield through selection. Both phenotypic and genotypic correlation coefficient analyses were conducted. The results revealed that fruit yield had a highly

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significant and positive correlation with fruit girth, fruit weight, number of fruits per plant, and harvest period. Conversely, a highly significant negative genotypic correlation was observed with days to 50% flowering, plant height, and days to first harvest. Path coefficient analysis provided further insights, indicating that days to first harvest, fruit weight, and the number of fruits per plant had positive direct effects on fruit yield per plant. In contrast, days to 50% flowering had a negative direct effect on yield. These findings suggest that selecting for traits such as earlier harvest, increased fruit weight, and a higher number of fruits per plant could lead to the development of superior okra cultivars with a balanced combination of traits, ultimately enhancing overall crop performance and sustainability in different agro-ecological zones.

Keywords: Genotypic correlation; phenotypic correlation; okra; path coefficient analysis.

1. INTRODUCTION

Okra (*Abelmoschus esculentus* (L.) Moench), is predominantly cultivated in the tropical and sub-tropical regions. Okra is familiarly termed as Bhendi, Lady's finger and Gumbo [1]. It stands as a key vegetable crop during the summer and rainy seasons. It is commonly accepted that okra's origin can be traced to the Hindustan region, mainly India, Pakistan, and Burma [2]. Okra is a member of the Malvaceae family and is recognized for its hibiscus-like flowers. The cultivated okra has a unique chromosome number of 2n = 130. In Bhendi, cross pollination is prevalent, varying between 4% and 19% [3]. A significant proportion of up to 42%, relies on entomophily, implying the importance of insects in facilitating pollen exchange among Bhendi flowers [4]. India stands as the foremost global producer of okra, contributing a substantial 73% to the total production of Okra. Renowned for its nutritional and medicinal properties, okra is an important source of vitamins, minerals, and fiber. The fresh green pods are rich in vitamin C, Vitamin A and Vitamin K as well as folate, calcium, potassium, and magnesium (Ranga et al., 2022). Biochemically, okra is notable for its high mucilage content, which has applications in both culinary and medicinal fields. Mucilage from okra is used as a natural thickening agent in foods, used as plasma alternative, helps in regulating blood sugar and cholesterol levels [5]. The seeds of okra are also rich in oil (16-20%) and protein, making them a valuable component in food and feed industries. Roasted and ground okra seeds are used as coffee substitute. Given that yield, being a quantitative trait, is influenced by diverse factors, a comprehensive understanding of the degree of association between yield and yield related attributes is crucial for designing effective breeding programs. Direct selection based on yield is ineffective because yield is a polygenically regulated variable. Yield is a dependent character determined by the interactions of different component traits with one another and with the crop's growing environment. Correlation studies are frequently utilized to examine the inter-relationships between dependent and independent variables, as the degree of improvement correlates with the genetic diversity present in genotypes [6]. However, correlation alone does not reveal the direct and indirect effects of traits on yield. Path coefficient analysis complements this by identifying cause-and-effect relationships, allowing for the development of selection indices to enhance yield [7]. It further distinguishes between direct influences on yield and indirect impacts through other traits, providing a clearer understanding of the factors contributing to yield, which is a complex trait influenced by multiple components.

2. MATERIALS AND METHODS

2.1 Experimental Material

The experimental materials employed in this research comprises of 48 diverse genotypes given in Table 1, including landraces, indigenous and exotic collections obtained from NBPGR, New Delhi and various other geographical locations of India.

2.2 Experimental Conditions

The research was conducted in an agriculture farm, near Sivapuri village, Tamil Nadu during January – May 2022. The genotypes were planted in three replications in randomized block design (RBD), five lines per genotype giving a spacing of 60 x 30 cm. Standard agronomic practices and pest control measures were implemented throughout the growing season.

Table 1. List of 48 genotypes used for study

S No.	Genotypes	Source
1.	IC 45732	NBPGR, New Delhi
2.	IC 45780	NBPGR, New Delhi
3.	IC 45815	NBPGR, New Delhi
4.	IC 45799	NBPGR, New Delhi
5.	IC 45805	NBPGR, New Delhi
6.	IC 45821	NBPGR, New Delhi
7.	IC 45818	NBPGR, New Delhi
8.	IC 44896	NBPGR, New Delhi
9.	IC 45791	NBPGR, New Delhi
10.	IC 45727	NBPGR, New Delhi
11.	IC 45802	NBPGR, New Delhi
12.	EC 329362	NBPGR, New Delhi
13.	EC 329364	NBPGR, New Delhi
14.	EC 329366	NBPGR, New Delhi
15.	EC 329368	NBPGR, New Delhi
16.	EC 329370	NBPGR, New Delhi
17.	EC 329382	NBPGR, New Delhi
18.	EC 329384	NBPGR, New Delhi
19.	Kashi Pragati	IIVR, Varanasi
20.	GFS Gold V4	Gujarat Farm Seeds, Anand
21.	Harika	Golden Valley Seeds, Hyd.
22.	Dhanvi 66	Dhanvi Seeds, Hyderabad
23.	Ajeet 121	Ajeet Seeds, Aurangabad
24.	Gold 207	Green Gold Seeds, U. P
25.	Ruchi	Sun Gold Agri Sciences, Hyd.
26.	Arka Anamika	IIHR, Bengaluru
27.	Super Champion	Bharat Crop Sciences, Jodhpur
28.	Nol 1307 (Silky)	Novel Seeds, Jalgaon
29.	Hari Pari	Hari Bhumi Seeds, Hisar
30.	Kashi Mangli (VRO-4)	IIVR, Varanasi
31.	Rani 792	Ramzin Affan Seeds, Ludhiana
32.	Lush Green	East-West Seeds, Aurangabad
33.	Maharani	Mahashakti seeds, Hisar
34.	Super Lady	Nath Bio Genes, Aurangabad
35.	Takath TS-102	Taiyo Gold Agri Biotech, Hyd.
36.	Palam Komal	CSKHPAU, Himachal Pradesh
37.	Red Round	PDR Gardens, Chennai
38.	1 Foot	PDR Gardens, Chennai
39.	Bommidi	PDR Gardens, Chennai
40.	Sunai	PDR Gardens, Chennai
41.	Tree	PDR Gardens, Chennai
42.	Colorful	PDR Gardens, Chennai
43.	Dark Green	PDR Gardens, Chennai
44.	IC 45811	NBPGR, New Delhi
45.	EC329375	NBPGR, New Delhi
46.	EC 329372	NBPGR, New Delhi
47.	EC 329378	NBPGR, New Delhi
48.	Suguna A51	Ananya Seeds, Hisar

2.3 Observations Recorded

For data collection, from each genotype 5 plants were randomly picked and tagged. Quantitative traits data were systematically recorded following the International Plant Genetic Resources Institute (IPGRI,1991) descriptor list for okra. The observations were taken from five tagged plants for 12 characters, *viz.*, days to 50% flowering (D50H), days to first harvest (DFH), number of primary branches per plant (NPB), fruit length (FL) (cm), plant height (PH) (cm), fruit weight (FW) (gm), fruit girth (FG) (mm), peduncle length (PL) (mm), number of locules per fruit (NLPF), harvest period (HP), number of fruits per plant (NFPP) and fruit yield per plant (FYPP) (kg).

2.4 Statistical Analysis

Calculations for genotypic correlation coefficients between characteristics were carried out using the components of variance and covariance, as outlined by Panse and Sukhatme [8]. Path coefficient analysis, as introduced by Wright [9] and refined by Dewey and Lu [10], was utilized to determine the direct and indirect contributions of various parameters to the overall correlation coefficients with total fruit yield per plant. The data analysis was carried out using TNAUSTAT and R programming software.

3. RESULTS AND DISCUSSION

The mean performance of all the accessions were given in Table 5. A positive correlation between desired traits is advantageous for plant breeders, as it enables the simultaneous enhancement of both traits. In terms of phenotypic correlation, fruit yield per plant showed a positive and significant correlation with fruit weight (0.788), harvest period (0.145), fruit girth (0.316) and number of fruits per plant (0.559) and a negative significant correlation with days to 50% flowering (-0.204), plant height (-0.208) and days to fruit harvest (-0.196) as mentioned in Table 2. A positively significant phenotypic correlation between yield and a character indicates that, at level of observable traits, increase in that character associates with the increase of yield. A significant and negative phenotypic correlation indicates that increase in that character results in the decrease on the yield. Since phenotypic correlation includes environmental effects, the observed relationship might be influenced by growing conditions. At genotypic level, fruit yield per plant exhibited a positive significant correlation with fruit weight (0.789), number of fruits per plant (0.559), harvest period (0.203), fruit girth (0.378) and a negative significant genotypic association with days to 50% flowering (-0.281), days to first harvest (-0.349) and plant height (-0.273) as shown in Table 3. A positively significant genotypic correlation coefficient among yield and a character indicates that, increase in that character indirectly increases the overall yield. And a negative significant genotypic correlation indicates that increase in that character decreases the overall yield. These traits can be focused on for genetic improvement since they are driven by genetic factors and result in consistent yield improvements across different environments since they are not influenced by environmental factors. Reddy et al. [11] observed a similar positive association of fruit yield per plant with the number of fruits per plant in okra. Archana et al. [12] reported a positive correlation with the harvest period, and Rynjah et al. [13] found a positive association with fruit girth in okra. Conversely, Thulasiram et al. [14] documented a negative association between fruit yield per plant and days to first fruit harvest in okra.

In path analysis at the genotypic level given in Table 4, the characters days to first harvest, number of fruits per plant and fruit weight exhibited high positive direct effect on fruit yield per plant. The improvement of these characteristics directly leads to an increase in the yield per plant. Days to 50% flowering and fruit girth exhibited negative direct effect on fruit yield per plant and an increase in the level of these traits leads to a decrease in the average yield per plant. Similar results were reported for positive direct effect on yield per plant by Komolafe et al. [15] and Rajani et al. [16] for number of fruits per plant and Tulasiram et al. [13] for fruit weight. Negative direct effects conform with those of Nbeaa et al. [17] for days to 50% flowering and Chavan et al. [18] for fruit girth in okra.

The residual effect was 0.03848, negligible and insignificant. A negligible residual effect in path analysis indicates that the method used in the path analysis effectively explains almost all the variability in the dependent variable [19]. This suggests that the traits included in the analysis are comprehensive and highly predictive. Comparison between significant correlation coefficient analysis and path analysis (direct effects) contributing to each trait towards fruit yield per plant indicated that fruit weight, number of fruits per plant and harvest period had significant positive correlation and positive direct effect on fruit yield per plant. These traits directly influence the yield and selection of these traits can effectively enhance overall crop performance. Fruit girth had significant positive correlation and negative direct effect on fruit yield. Traits plant height and days of first harvest had significant negative correlation and positive direct effect on fruit yield per plant. While the character days to 50% flowering had negative significant correlation and negative direct effect on fruit yield per plant.

Table 2. Phenotypic Correlation coefficient estimates of traits in Okra

Traits	D50F	PH	NPB	DFH	FL	FT	FW	PL	NLPP	NFPP	HP	FYPP
D50F	1.00	-0.022	-0.338**	0.603**	-0.191**	0.202*	0.117	0.152	0.120	-0.446*	0.179*	-0.204*
PH		1.00	0.197*	-0.093	0.276*	-0.175	-0.253**	0.200	0.071	-0.006	-0.003	-0.208*
NPB			1.00	-0.349**	0.016	0.074	-0.014	-0.013	0.052	0.103	0.140	0.080
DFH				1.00	-0.093	0.093	-0.015	0.191*	0.170*	-0.308**	0.042	-0.196*
FL					1.00	-0.160	-0.015	0.122	0.014	0.088	-0.036	0.098
FG						1.00	0.622**	-0.085	0.472**	-0.256**	0.296**	0.316**
FW							1.00	-0.031	0.314**	0.024	0.235**	0.788**
PL								1.00	0.155	-0.011	0.064	-0.051
NLPP									1.00	-0.196	0.136	0.115
NFPP										1.00	-0.072	0.559**
HP											1.00	0.145*
FYPP												1.00

**, ** indicate level of significance at 5% and 1%, respectively.*

D50F: Days to 50% flowering; PH: Plant height (cm); NPB: Number of primary branches per plant; DFH: Days to first harvest; FL: Fruit length (cm); FW: Fruit weight (gm); FG: Fruit girth (mm); PL: Peduncle length (cm); NLPF: Number of locules per fruit; NFPP: Number of fruits per plant; HP: Harvest period; FYPP: Fruit yield per plant (kg).

Table 3. Genotypic Correlation coefficient estimates of traits in Okra

Traits	D50F	PH	NPB	DFH	FL	FT	FW	PL	NLPP	NFPP	HP	FYPP
D50F	**1.00**	-0.056	-0.448**	0.865**	-0.245	0.359	0.186	0.223	0.128	-0.653	0.265	-0.281**
PH		**1.00**	0.255	-0.081	0.342	-0.214	-0.311	0.269**	0.085	-0.031	-0.001	-0.273*
NPB			**1.00**	-0.548	0.033	0.106	-0.026	0.061	0.067	0.114	0.204	0.089
DFH				**1.00**	-0.066	0.158	-0.020	0.280	0.218	-0.533	0.076	-0.349*
FL					**1.00**	-0.251	-0.023	0.139	0.006	0.111	-0.040	0.120
FG						**1.00**	0.767	-0.109	0.547**	-0.314	0.394**	0.378*
FW							**1.00**	-0.100	0.353	0.005	0.306	0.789**
PL								**1.00**	-0.182	-0.020	0.018	-0.081
NLPP									**1.00**	-0.222	0.175	0.133
NFPP										**1.00**	-0.106	0.559**
HP											**1.00**	0.203*
FYPP												**1.00**

**, ** indicate level of significance at 5% and 1%, respectively.*

D50F: Days to 50% flowering; PH: Plant height (cm); NPB: Number of primary branches per plant; DFH: Days to first harvest; FL: Fruit length (cm); FW: Fruit weight (gm); FG: Fruit girth (mm); PL: Peduncle length (cm); NLPF: Number of locules per fruit; NFPP: Number of fruits per plant; HP: Harvest period; FYPP: Fruit yield per plant (kg).

Table 4. Genotypic Path matrix (diagonal and bold are direct effects and off diagonal are indirect effects) for fruit yield per plant in okra

Traits	D50F	PH	NPB	DFH	FL	FT	FW	PL	NLPP	NFPP	HP	FYPP
D50F	**-0.440**	-0.0018	-0.0246	0.2795	0.0099	-0.0706	0.1936	-0.0016	-0.0105	-0.2408	0.0254	-0.282
PH	0.0247	**0.033**	0.0140	-0.0263	-0.0138	0.0422	-0.3231	-0.0020	-0.0070	-0.0116	-0.0001	-0.270
NPB	0.1971	0.0083	**0.055**	-0.1771	-0.0014	-0.0210	-0.0272	-0.0004	-0.0055	0.0424	0.0197	0.090
DFH	-0.3808	-0.0027	-0.0302	**0.323**	0.0027	-0.0312	-0.0209	-0.0020	-0.0178	-0.1966	0.0074	-0.349
FL	0.1081	0.0112	0.0019	-0.0213	**-0.040**	0.0494	-0.0241	-0.0010	-0.0006	0.0411	-0.0039	0.121
FT	-0.1580	-0.0070	0.0059	0.0512	0.0102	**-0.197**	0.7949	0.0008	-0.0446	-0.1160	0.0378	0.378
FW	-0.0821	-0.0102	-0.0014	-0.0065	0.0009	-0.1508	**1.036**	0.0007	-0.0288	0.0019	0.0294	0.789
PL	-0.0982	0.0088	0.0034	0.0905	-0.0057	0.0216	-0.1037	**-0.007**	0.0149	-0.0077	0.0018	-0.081
NLPP	-0.0567	0.0028	0.0037	0.0705	-0.0003	-0.1077	0.3666	0.0013	**-0.081**	-0.0818	0.0168	0.134
NFPP	0.2874	-0.0010	0.0063	-0.1722	-0.0045	0.0619	0.0054	0.0002	0.0181	**0.368**	-0.0102	0.559
HP	-0.1165	-0.0004	0.0113	0.0248	0.0016	-0.0775	0.3174	-0.0001	-0.0143	-0.0392	**0.096**	0.203

D50F: Days to 50% flowering; PH: Plant height (cm); NPB: Number of primary branches per plant; DFH: Days to first harvest; FL: Fruit length (cm); FW: Fruit weight (gm); FG: Fruit girth (mm); PL: Peduncle length (cm); NLPF: Number of locules per fruit; NFPP: Number of fruits per plant; HP: Harvest period; FYPP: Fruit yield per plant (kg).

Table 5. Mean Performance of 48 accessions of Okra

S. No	Genotypes	D50F	PH	NPB	DFH	FL	FT	FW	PL	NLPP	NFPP	HP	FYPP
1	IC 45732	42.33	66.50	3.33	48.67	15.34	20.14	24.00	1.76*	6.34	35.67**	65.67**	0.75**
2	IC 45780	42.67	99.80**	4.00	48.67	14.49	25.83**	15.98	1.71**	8.11	23.66	51.33	0.38
3	IC 45815	40.67	85.82	3.07	46.67	18.74**	21.18	39.16**	2.10	5.43*	32.47**	62.67	1.27**
4	IC 45799	44.67	109.20**	4.27*	49.33	14.32	17.07	16.57	1.96	5.45*	22.83	62.33	0.44
5	IC 45805	39.00**	77.77	5.07**	46.67	15.47	23.64	29.67**	2.37	6.93	39.33**	64.00*	1.19**
6	IC 45821	41.67	99.07*	4.27*	47.33	16.50*	15.26	15.42	1.98	5.20**	32.92**	56.67	0.48
7	IC 45818	46.00	84.47	3.80	52.33	13.50	19.84	13.03	2.72	7.40	21.27	61.67	0.28
8	IC 44896	45.33	88.37	2.73	51.67	15.57	17.33	22.50	1.74**	6.60	39.33**	60.33	0.89**
9	IC 45791	43.67	96.66*	4.40**	48.67	19.07**	15.84	14.37	2.45	6.27	25.73	63.67*	0.37
10	IC 45727	40.33	110.53**	3.40	46.67	12.60	22.29	15.10	2.65	6.33	35.00**	66.00**	0.53
11	IC 45802	39.33*	81.03	4.27*	46.33	13.40	21.76	19.17	2.14	5.67	21.47	60.33	0.41
12	EC 329362	41.67	68.08	3.33	48.33	15.73	22.49	25.93*	2.01	7.13	20.20	56.67	0.52
13	EC 329364	42.33	77.32	3.60	49.00	13.27	26.81**	23.20	1.94	8.45	22.73	58.67	0.53
14	EC 329366	41.00	71.73	2.67	50.33	11.17	15.57	12.80	1.59**	7.13	28.70	60.33	0.37
15	EC 329368	41.67	72.43	3.20	49.00	13.62	21.15	37.43**	2.12	6.13	38.93**	51.67	0.97**
16	EC 329370	41.33	77.30	4.20*	45.67	13.79	22.51	23.00	2.80	5.47*	31.13**	56.33	0.72*
17	EC 329382	44.33	94.63	3.67	48.67	17.80**	16.64	22.90	2.12	7.13	17.97	59.33	0.41
18	EC 329384	42.67	86.67	4.07	46.33	11.33	16.41	24.10	2.01	6.60	27.00	57.67	0.65*
19	Kashi Pragati	40.33	98.57*	3.23	46.33	13.30	16.54	20.00	1.97	5.53*	27.33	61.67	0.55
20	GFS Gold V4	42.33	85.50	3.80	47.67	12.17	18.25	18.80	2.42	5.20**	26.87	59.00	0.51
21	Harika	43.67	79.43	3.87	49.33	12.06	19.51	17.53	2.34	5.07**	24.60	59.67	0.43
22	Dhanvi 66	44.00	80.67	2.13	50.67	16.90**	16.73	21.53	2.49	5.00**	23.67	51.00	0.51
23	Ajeet 121	44.33	82.57	3.07	49.33	14.53	18.68	17.00	1.92	5.20**	25.07	59.00	0.42
24	Gold 207	41.33	99.80**	4.60**	47.67	11.73	16.54	12.67	2.44	5.13**	31.47**	59.00	0.40
25	Ruchi	44.00	78.63	2.30	51.67	16.20*	19.83	25.40*	2.30	5.00**	24.67	53.33	0.69*
26	Arka Anamika	46.00	93.10	2.87	46.67	14.53	15.36	16.17	2.12	5.07**	23.93	63.00	0.39
27	Super Champion	46.00	88.73	2.03	48.67	16.87**	17.22	14.13	2.20	5.33**	27.27	60.33	0.39
28	Nol 1307	43.33	72.60	3.77	48.00	12.80	19.68	16.20	2.12	5.00**	23.67	56.67	0.38
29	Hari Pari	44.00	82.87	3.90	46.67	14.25	16.90	13.13	2.01	5.00**	21.20	57.00	0.28
30	Kashi Mangli	46.33	80.97	3.90	49.67	12.41	18.56	13.63	1.97	5.33**	26.87	60.67	0.37
31	Rani 792	43.67	72.10	3.60	47.67	13.93	16.72	15.87	2.13	5.23**	19.93	61.67	0.32
32	Lush Green	42.00	94.83	3.53	47.67	15.13	16.78	19.17	3.13	5.27**	29.40*	60.00	0.56

S. No	Genotypes	D50F	PH	NPB	DFH	FL	FT	FW	PL	NLPP	NFPP	HP	FYPP
33	Maharani	43.33	86.00	3.73	49.33	12.10	16.18	17.20	2.31	5.27**	28.80	59.00	0.50
34	Super Lady	43.33	99.77**	3.87	48.00	14.47	16.45	16.97	1.97	5.33**	25.67	56.67	0.43
35	Takath TS-102	43.67	83.83	3.47	47.67	13.73	16.49	15.50	2.32	5.00**	28.73	56.33	0.45
36	Palam Komal	43.00	109.73**	3.53	46.33	14.90	15.64	13.69	3.01	5.07**	33.00**	55.67	0.45
37	Red Round	48.33	78.40	3.27	54.67	11.97	17.06	15.53	2.40	4.87**	17.90	62.00	0.28
38	1 Foot	48.67	112.53**	4.10	53.67	20.03**	30.30**	34.47**	3.14	7.87	16.13	68.33**	0.56
39	Bommidi	52.00	94.90	2.20	56.33	10.97	18.92	24.03	3.13	7.47	18.07	57.00	0.43
40	Sunai	44.33	67.97	4.67**	49.33	13.77	23.00	31.27**	2.68	5.23**	26.93	67.33**	0.84**
41	Tree	42.67	83.47	4.40**	44.67*	9.33	38.58**	49.33**	1.75*	7.33	19.80	64.67*	0.98**
42	Colorful	52.33	65.63	2.13	56.00	9.73	35.80**	33.87**	1.83*	6.59	13.00	68.33**	0.44
43	Dark Green	47.67	78.29	3.13	54.33	12.73	19.35	14.10	2.94	5.20**	23.30	55.00	0.33
44	IC 45811	41.00	83.40	3.73	48.33	16.20*	19.58	13.26	2.40	5.13**	27.20	57.33	0.36
45	EC329375	43.33	101.23**	3.87	50.67	14.80	17.58	14.12	2.75	5.33**	22.60	61.33	0.32
46	EC 329372	44.67	101.17**	4.13	50.00	14.83	18.11	13.46	2.18	6.20	25.67	60.33	0.35
47	EC 329378	41.67	110.78**	4.07	50.00	16.33*	19.86	13.02	1.78*	7.10	16.00	56.00	0.21
48	Suguna A51	43.67	93.93	4.00	50.33	14.03	22.55	21.30	2.14	5.37**	27.13	57.33	0.59
Mean		**43.66**	**87.27**	**3.59**	**49.12**	**14.22**	**19.89**	**20.35**	**2.26**	**5.93**	**25.88**	**59.58**	**0.52**
Minimum		**39.00**	**65.63**	**2.03**	**44.67**	**9.33**	**15.26**	**12.67**	**1.59**	**4.87**	**13.00**	**51.00**	**0.21**
Maximum		**52.33**	**112.53**	**5.07**	**56.33**	**20.03**	**38.58**	**49.33**	**3.14**	**8.45**	**39.33**	**68.33**	**1.27**
CV		**4.94**	**6.51**	**10.41**	**4.80**	**8.00**	**12.13**	**14.52**	**10.73**	**4.21**	**7.13**	**4.23**	**23.89**
Mean standard error		**1.25**	**3.28**	**0.22**	**1.36**	**0.66**	**1.39**	**1.71**	**0.14**	**0.14**	**1.07**	**1.45**	**0.07**
CD 5%		**3.48**	**9.18**	**0.60**	**3.81**	**1.84**	**3.90**	**4.78**	**0.39**	**0.40**	**2.99**	**4.07**	**0.13**
CD 1%		**4.64**	**12.19**	**0.80**	**5.06**	**2.44**	**5.17**	**6.34**	**0.52**	**0.53**	**3.96**	**5.40**	**0.18**

**, ** indicate level of significance at 5% and 1%, respectively.*

D50F: Days to 50% flowering; PH: Plant height (cm); NPB: Number of primary branches per plant; DFH: Days to first harvest; FL: Fruit length (cm); FW: Fruit weight (gm); FG: Fruit girth (mm); PL: Peduncle length (cm); NLPF: Number of locules per fruit; NFPP: Number of fruits per plant; HP: Harvest period; FYPP: Fruit yield per plant (kg).

4. CONCLUSION

In the present study, fruit yield per plant exhibited a positive correlation with many agronomic traits, including fruit weight, number of fruits per plant, harvest period, and fruit girth. This indicates that selecting and improving these traits could significantly enhance the overall yield potential in okra. Also, the traits such as number of fruits per plant, fruit weight, and days to first harvest not only showed a positive correlation but also exhibited a positive and direct effect on yield, as revealed by path coefficient analysis. This finding highlights their importance in determining yield performance, as improvements in these traits would lead to an immediate and measurable increase in yield. The harvest period and fruit girth, although positively linked to yield, likely impact it both directly and indirectly, showing how different traits work together to influence overall yield. By focusing on these yield-contributing traits, plant breeders can develop superior okra genotypes with enhanced productivity.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Authors hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Patel AA, Vekariya RD, Patel R and Patel A. Selection of elite genotypes deploying AMMI, GGE and MTSI in okra (*Abelmoschus esculentus* (L.) Moench). South African Journal of Botany 2023;163:457-467.
2. Gola SK, Kumar K, Yugvinder US, Kumar N. Effect of sowing date and varieties on growth and yield of okra. The Pharma Innovation Journal. 2021;10(10):903-910.
3. Verma A, Sood S, Singh Y. Combining ability studies for yield and contributing traits in okra (*Abelmoschus esculentus* L. Moench). Journal of Applied and Natural Science. 2016;8(3):1594-1598.
4. Kumar N. Breeding of Horticultural Crops. New India Publishing. 2006;173-177.
5. Das S, Nandi G, Ghosh LK. Okra and its various applications in drug delivery, food technology, health care and pharmacological aspects-a review. Journal of Pharmaceutical Sciences and Research. 2019;11(6):2139-2147.
6. Rahaman MA. Genetic diversity, correlation and path co-efficient analysis for yield of commercial maize varieties (*Zea mays* L.) (Doctoral dissertation, Department of Genetics and Plant Breeding, Sher-E-Bangla Agricultural University, Dhaka, Bangladesh); 2015.
7. Viotto Del Conte M, Carneiro PCS, Vilela de Resende MD, Lopes da Silva F, Peternelli LA. Overcoming collinearity in path analysis of soybean [*Glycine max* (L.) Merr.] grain oil content. Plos one. 2020;15(5):e0233290.
8. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. Icar, New Delhi. P. 1967;134-192.
9. Wright S. Systems of mating 1. The biometric relations between parent and offspring. Genetics. 1921;6:111-123.
10. Dewey DR, Lu KH. Correlation and path coefficient analysis of crested wheat grass seed production. Agrion. J. 1959;51:515-518.
11. Reddy MT, Babu KH, Ganesh M, Reddy KC, Begum H, Reddy RSK, Babu JD. Correlation and path coefficient analysis of quantitative characters in okra (*Abelmoschus esculentus* (L.) Moench). Songklanakarin Journal of Science and Technology. 2013;35(3):243-250.
12. Archana M, Mishra HN, Senapati N, Tripathy P. Genetic variability and correlation studies in okra (*Abelmoschus esculentus* (L.) Moench). Electronic Journal of Plant Breeding. 2015;6(3):866-869.
13. Rynjah S, Arumugam T, Ganesan KN, Kamal Kumaran PR. Correlation and path coefficient analysis studies in okra (*Abelmoschus esculentus* (L.) Moench). Journal of Pharmacognosy and Phytochemistry. 2020;9(3):1423-1427.
14. Thulasiram LB, Bhople SR, Mekala S, Ravi NB. Genetic Variability and Heritability Studies in okra (*Abelmoschus esculentus* (L.) Moench). Electronic Journal of Plant Breeding. 2017;8(2):620-625.
15. Komolafe RJ, Ariyo OJ, Alake CO. Correlation and Path Coefficient Analysis

of Fruit Yield Attributes in Forty Genotypes of Okra (*Abelmoschus esculentus* (L.) Moench). Agric. Res. 2022;11(1):15-23.

16. Rajani A, Naidu LN, Madhavi Y, Srikanth D. Path coefficient analysis studies in okra (*Abelmoschus esculentus* (L.) Moench). Pharma Innovation. 2022;11(2):2050-2053.
17. Nbeaa RA, Abo-Trabi B, Ahmad E. Phenotypic Correlation and Path Coefficient and Relative Importance Studies in Okra (*Abelmoschus esculentus* (L.) Moench). Basrah Journal of Agricultural Sciences. 2023;36(1):50-59.
18. Chavan J, Seenivasan N, Saidaiah P and Sivaraj N. Estimation of correlation coefficient and path coefficient analysis for yield and yield components in Okra (*Abelmoschus esculentus* (L.) Moench). International Journal of Chemical Studies. 2019;7(4):1254-1260.
19. Mohammed J, Mohammed W, Shiferaw E. Correlation and path coefficient analysis among agro-morphological and biochemical traits of okra (*Abelmoschus esculentus* (L.) Moench) genotypes in Ethiopia. Acta agriculturae Slovenica. 2020;115(2):329-339.

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